UNIVERSITI TEKNOLOGI MARA

# QUANTITATIVE DETERMINATION ON BIODEGRADATION OF PAHs BY BACTERIA FROM OIL SLUDGE

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# ABSTRACT

The biodegradability of petroleum waste product was evaluated using oil sludge taken from Exxon Mobil petroleum refinery treatment plant in Kerteh, Terengganu. This study was a further extension of studies conducted by Dzulkafli (2007) where the qualitative analysis was established. The analysis involves the utilization of bacterial strains most effective in PAHs degradation as classified by Dzulkafli (2007). The PAHs adopted were phenanthrene, anthracene and dibenzothiophene which were used as source of carbon. PCR and DNA Sequencing were conducted to confirm the identity of bacterial strain classified by Dzulkafli (2007). These molecular techniques provides up to 90% accuracy of identification. Using these techniques these three strains identified belong to genus of *Pseudomonas* namely; Uncultured *Pseudomonas sp.* clone 2-A, *Pseudomonas Stutzeri strain* HS-D36 and *Pseudomonas Stutzeri strain* LS401. Turbidity test was conducted for growth rates of each strain. *Pseudomonas Stutzeri strain* HS-D36 indicated the highest growth rates followed by Uncultured *Pseudomonas sp.* clone 2-A and *Pseudomonas Stutzeri strain* LS401. Identification of the most effective PAH degrading by bacterial strain was established by determining of average degradation rates. Anthracene proved to be the most degraded by these strains with the highest average degradation rate followed by phenanthrene and dibenzothiophene. While, *Pseudomonas Stutzeri strain* HS-D36 revealed to be the best strain in degrading PAHs, with the highest degradation followed by Uncultured *Pseudomonas sp.* clone 2-A and *Pseudomonas Stutzeri strain* LS401.



Keywords: bacterial strain, biodegradation, DNA Sequencing, oil sludge, PCR, poly aromatic hydrocarbons (PAHs), Pseudomonas,

## Candidate's Declaration

I declare that the work in this dissertation was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as referenced work. This topic has not been submitted to any other academic institution or non-academic institution for any other degree or qualification.

In the event my thesis be found to violate the conditions mentioned above, I voluntarily waive the right of conferment of my degree and agree be subjected to the disciplinary rules and regulations of Universiti Teknologi MARA.

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# CHAPTER 1

# INTRODUCTION

## 1.1 Background of Study

Large quantities of organic and inorganic compounds are released into the environment every year as a result of human activities. Contaminated land is a typical consequence of industrial activities such as the petroleum industry. A variety of waste is generated during the petroleum-refining process which requires treatment before they can be safely disposed off (Marin *et al.*, 2005). Oil refineries generate huge volumes of sludge during the refining of crude oil. These sludges have a high content of petroleum-derived hydrocarbons consisting of mainly alkanes and paraffin of 1-40 carbon atoms, along with cycloalkanes and aromatic compounds (Overcash and Pal, 1979). Polycyclic aromatic hydrocarbons (PAHs) are pollutants that can easily enter the environment as a result from the oil spills which can pollute soil and water (Moretto *et al.*, 2005). Indiscriminate and improper disposal and handling of oily sludge contaminates soil which may pose a serious risk to human health as a result of their toxic, mutagenic and carcinogenic properties (Kastner *et al.*, 1994).

There are modern treatment methods that are applicable to the petroleum industry in Malaysia, namely, soil vapor extraction (SVE), natural attenuation, enhanced attenuation, containment and bioremediation (Yin *et al.*, 2007). The selection of remediation technology for clean-up of contaminated land is reliant on various factors such as local soil conditions, hydro geological conditions and the type of contaminants. However, cost plays a major factor for industries in deciding the method to be used for cleaning up contaminated sites.